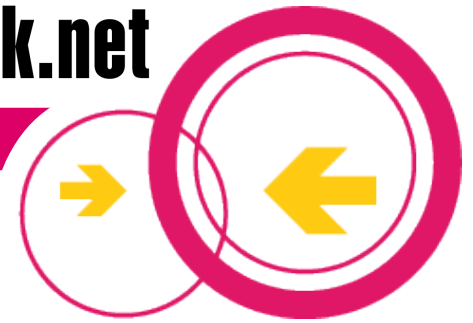


Chaostreff Augsburg, 29.11.2012

**OpenWrt**  
**Wireless Freedom**

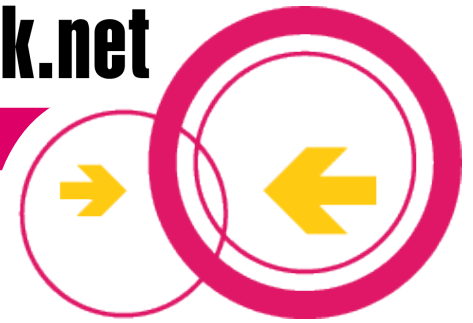
Manuel Munz

soma@augzburg.freifunk.net



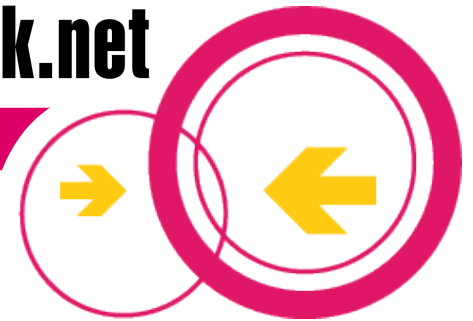
# Übersicht

- Was ist OpenWrt?
- OpenWrt benutzen
- Hacking OpenWrt



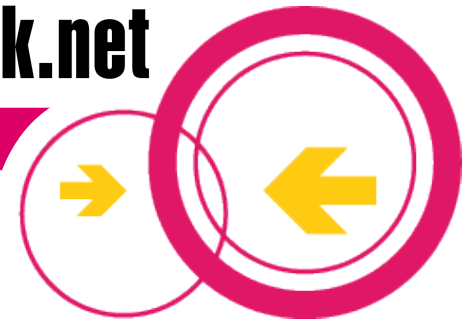
# OpenWrt

- Minimalistische Linux/Busybox Distribution
- hauptsächlich für Wireless Router
- Läuft auf billiger Hardware
- modular und flexibel anpassbar → “Meta Distribution”
- GPL
- Nächstes Release: 12.09 Attitude Adjustment



# Features

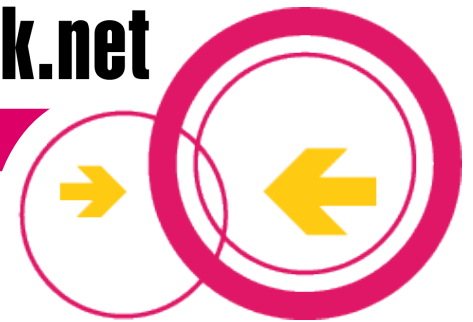
- 50+ Targets (Mips, Arm, X86...)
- 2000+ Pakete
- rw-filesystem
- Komfortabler Paketmanager
- UCI
- Buildroot
- Externe Webinterfaces



# Einsatzgebiete

- Funktionsumfang günstiger Soho Router erweitern
- Router, Firewall, VPN, Hotspot, Jukebox, Webcam, VoIP, IPv6, sparsame VMs, Home Automation, Steuerungen...
- Optimiert für kleine Geräte: 16MB RAM/4MB Flash
- Custom Firmwares, z.B. Fon, Freifunk

=> günstige, stromsparende Mini-Linux-Rechner

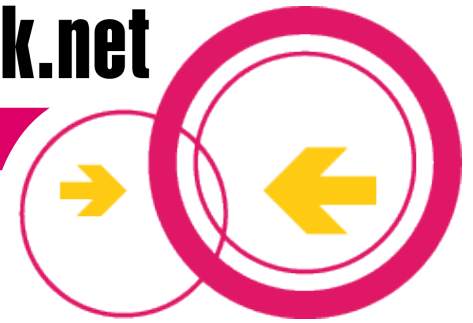


# Geschichte

- 2003 WRT54G, GPL-Violations
- 2004 OpenWrt.org, Linksys GPL Sources  
dann Neuanfang “from scratch”  
→ **“stable release”**, WRT54G
- 2005 **“White Russian”**  
weitere BR947xx Geräte  
Neues Buildroot (basierend auf  
uClibc Buildroot2)



Bild: Cun, Wikipedia



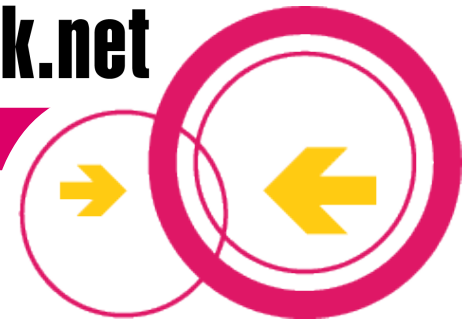
# Geschichte II - Kamikaze

## 2007 “Kamikaze”

- UCI statt NVRAM config
- Neues Buildsystem
- Wechsel zu Ubuntu Naming Scheme (7.06)
- 8 Targets
- Linux 2.6 (Broadcom auch 2.4)
- LuCI Webinterface



Bild: Momoji3, Wikipedia



# Geschichte III - Backfire

2010 "Backfire" 10.03

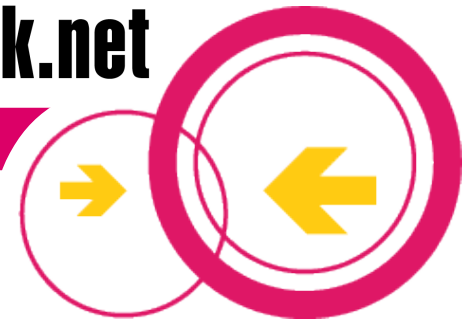
- Mehr Targets
- LuCI 0.10

```
-----  
| | W I R E L E S S   F R E E D O M  
-----  
Backfire (10.03, r20728) -----  
* 1/3 shot Kahlua   In a shot glass, layer Kahlua  
* 1/3 shot Bailey's on the bottom, then Bailey's,  
* 1/3 shot Vodka   then Vodka.  
-----
```



Bilder: <http://omasse.blogspot.com/2010/06/what-running-backfire-on-wli-tx4-g54hp.html>





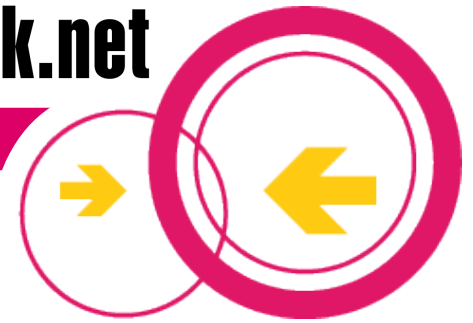
# Geschichte IV – Attitude Adjustment

2012 “Attitude Adjustment” 12.09 (?)

- Netifd, ubusd
- 50+ Targets, 2000+ Pakete
- Luci 0.11

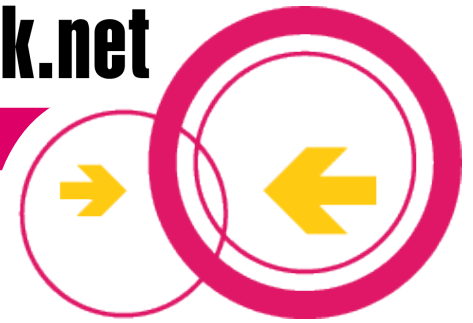
```

- - - - -
|_| W I R E L E S S   F R E E D O M
ATTITUDE ADJUSTMENT (bleeding edge, r28941)
* 1/4 oz Vodka      Pour all ingredients into mixing
* 1/4 oz Gin        tin with ice, strain into glass.
* 1/4 oz Amaretto
* 1/4 oz Triple sec
* 1/4 oz Peach schnapps
* 1/4 oz Sour mix
* 1 splash Cranberry juice
-----
root@OpenWrt:~#
```



# Struktur des Projekts

- Freiwillige
- Keine formale Organisation
- Demokratisch, konsensbasiert



# Benutzen I – Get Open Wrt

- Kompatibilität Router, Hilfe → ToH
- Release vs. bleeding edge
- Factory vs. Sysupgrade
- [downloads.openwrt.org](http://downloads.openwrt.org)

## Index of /

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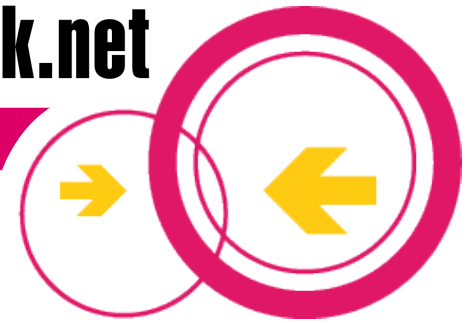
[../](#)  
[attitude\\_adjustment/](#)  
[backfire/](#)  
[backports/](#)  
[docs/](#)  
[kamikaze/](#)  
[people/](#)  
[reference/](#)  
[snapshots/](#)  
[sources/](#)  
[utils/](#)  
[whiterussian/](#)  
[favicon.ico](#)

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## Index of /backfire/10.03.1/ar71xx/

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<a href="#">../</a>	21-Dec-2011 00:57	-
<a href="#">packages/</a>	21-Dec-2011 01:50	422824482
<a href="#">OpenWrt-ImageBuilder-ar71xx-for-Linux-i686.tar.bz2</a>	21-Dec-2011 01:40	609675587
<a href="#">OpenWrt-SDK-ar71xx-for-Linux-i686-gcc-4.3.3+cs...&gt;</a>	21-Dec-2011 01:50	15239610
<a href="#">OpenWrt-Toolchain-ar71xx-for-mips_r2-gcc-4.3.3+...&gt;</a>	21-Dec-2011 00:17	149887
<a href="#">config</a>	21-Dec-2011 01:01	97462759
<a href="#">kernel-debug.tar.bz2</a>	21-Dec-2011 01:53	10919
<a href="#">md5sums</a>	21-Dec-2011 01:03	3866648
<a href="#">openwrt-ar71xx-a02-rb-w300n-squashfs-factory.bin</a>	21-Dec-2011 01:03	2949124
<a href="#">openwrt-ar71xx-a02-rb-w300n-squashfs-sysupgrade...&gt;</a>	21-Dec-2011 01:02	4653060
<a href="#">openwrt-ar71xx-ap81-jffs2-sysupgrade.bin</a>	21-Dec-2011 01:03	1245184
<a href="#">openwrt-ar71xx-ap81-kernel.bin</a>	21-Dec-2011 01:02	3407872
<a href="#">openwrt-ar71xx-ap81-rootfs-jffs2.bin</a>	21-Dec-2011 01:03	2097152
<a href="#">openwrt-ar71xx-ap81-rootfs-squashfs.bin</a>	21-Dec-2011 01:03	3342340
<a href="#">openwrt-ar71xx-ap81-squashfs-sysupgrade.bin</a>	21-Dec-2011 01:02	4653060
<a href="#">openwrt-ar71xx-ap83-jffs2-sysupgrade.bin</a>	21-Dec-2011 01:03	1245184
<a href="#">openwrt-ar71xx-ap83-kernel.bin</a>	21-Dec-2011 01:02	3407872
<a href="#">openwrt-ar71xx-ap83-rootfs-jffs2.bin</a>	21-Dec-2011 01:03	2097152
<a href="#">openwrt-ar71xx-ap83-rootfs-squashfs.bin</a>	21-Dec-2011 01:03	3342340
<a href="#">openwrt-ar71xx-ap83-squashfs-sysupgrade.bin</a>	21-Dec-2011 01:03	3735576
<a href="#">openwrt-ar71xx-dir-600-a1-squashfs-factory.bin</a>	21-Dec-2011 01:03	2949124
<a href="#">openwrt-ar71xx-dir-600-a1-squashfs-sysupgrade.bin</a>	21-Dec-2011 01:03	3866648
<a href="#">openwrt-ar71xx-dir-615-c1-squashfs-factory.bin</a>	21-Dec-2011 01:03	2949124
<a href="#">openwrt-ar71xx-dir-615-c1-squashfs-sysupgrade.bin</a>	21-Dec-2011 01:03	2949124

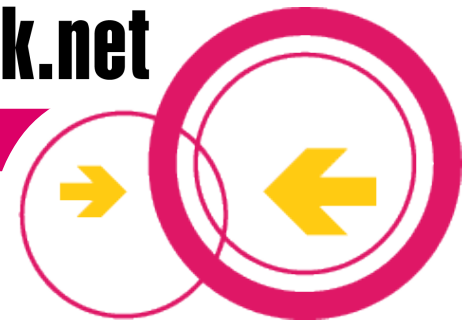


## Benutzen I – Installation

- OEM Firmware: Webinterface (OEM), Bootloader Rescue Mode, Via Serielle oder Tftp Upload
- Von OpenWrt aus: Webinterface, mtd, sysupgrade

```
root@10-11-0-101:/tmp# wget http://meshkit.freifunk.net/images//fcelb9d7d82c8fca9421022a2552adb3/bin/openwrt-ar71xx-generic-tl-wr1043nd-v1-squashfs-sysupgrade.bin
Connecting to meshkit.freifunk.net (109.163.229.250:80)
openwrt-ar71xx-gener 100% |*****| 3584k 0:00:00 ETA
root@10-11-0-101:/tmp# sysupgrade -n openwrt-ar71xx-generic-tl-wr1043nd-v1-squashfs-sysupgrade.bin
Sending TERM to remaining processes ... uhttpd uhttpd dnsmasq ntpd ffwatcd crond lock syslogd klogd hotplug
2 ubusd netifd
Sending KILL to remaining processes ... uhttpd uhttpd crond
Switching to ramdisk...
Performing system upgrade...
Unlocking firmware ...

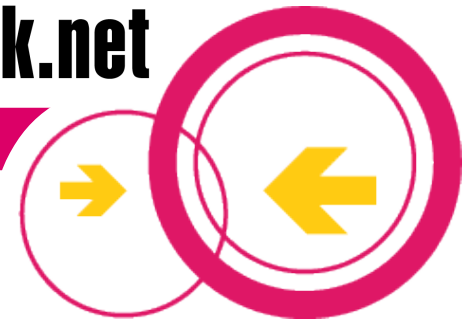
Writing from <stdin> to firmware ...
Upgrade completed
Rebooting system...
```



## Benutzen II – Erster Login

- WAN firewalled
- WIFI deaktiviert
- SSH deaktiviert
- # telnet 192.168.1.1

Nach Passwort setzen: telnet deaktiviert, sshd aktiv



# Konfiguration – UCI

```
# cat /etc/config/system
```

```
config system 'system'
```

```
option hostname 'AwesomeOpenWrt'
```

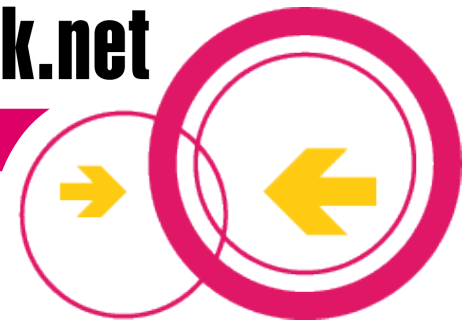
```
option timezone 'CET-1CEST,M3.5.0,M10.5.0/3'
```

```
config timeserver 'ntp'
```

```
list server '0.openwrt.pool.ntp.org'
```

```
list server '1.openwrt.pool.ntp.org'
```

```
[...]
```



# Konfiguration – UCI cmdline

```
# uci show system
```

```
system.system=system
```

```
system.system.zonename=Europe/Berlin
```

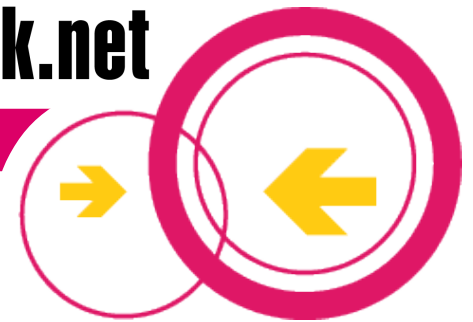
```
system.system.hostname=AwesomeOpenWrt
```

```
system.system.timezone=CET-1CEST,M3.5.0,M10.5.0/3
```

```
system.ntp=timeserver
```

```
system.ntp.server=0.openwrt.pool.ntp.org 1.openwrt.pool.ntp.org  
2.openwrt.pool.ntp.org 3.openwrt.pool.ntp.org
```

```
[...]
```



## Konfiguration – UCI cmdline II

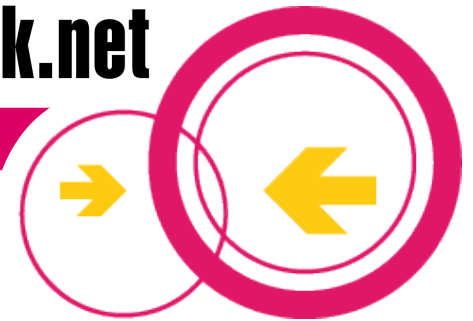
```
# uci get system.system.hostname  
AwesomeOpenWrt
```

```
# uci set system.system.hostname='foobar'
```

```
# uci add_list system.ntp.server='ntp1.ptb.de'
```

```
# uci commit (oder revert)
```





# Konfiguration – LuCI

## System

An dieser Stelle können Grundeinstellungen des Systems wie Hostname oder Zeitzone vorgenommen werden.

### Systemeigenschaften

Allgemeine Einstellungen **Protokollierung** Sprache und Aussehen

Lokale Zeit: Wed Nov 28 14:00:52 2012

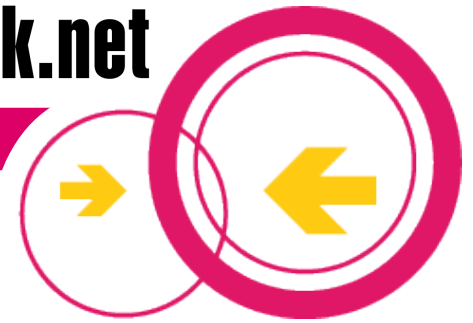
Hostname:

Zeitzone:

### Zeitsynchronisation

NTP Server aktivieren

- NTP Server Kandidaten
- - 
  - 
  -



# Paketmanager: opkg

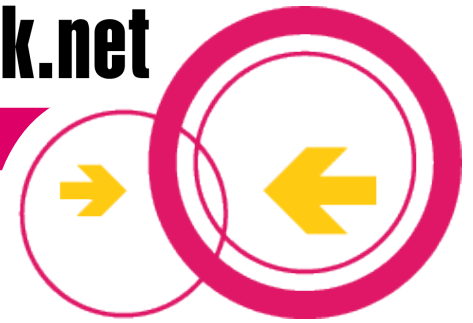
```
# opkg list_installed  
# opkg update  
# opkg install olsrd  
# opkg remove olsrd
```

Paketquellen: /etc/opkg.conf

```
src/gz pkgs http://<url>/bcm47xx/trunk/packages/
```

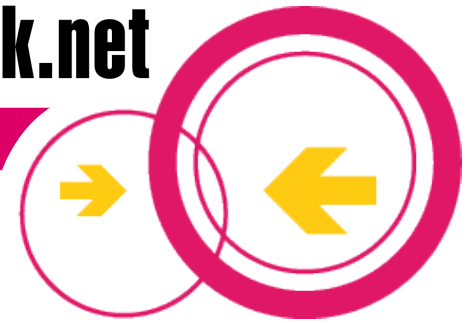
Besonderheit: Dämons

```
# /etc/init.d/olsrd enable
```



# Finally: Hacking OpenWrt

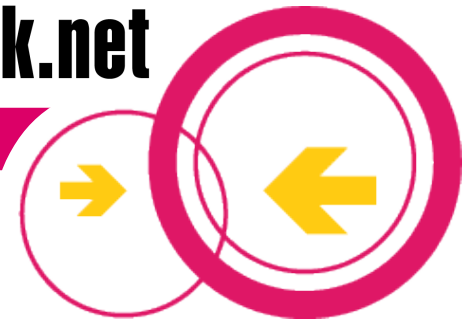
- Buildroot
- Image Generator
- Debricking
- Hardware Hacks



# Buildroot

- Sammlung von Makefiles
- Sourcen extern
- Cross-Compiler Toolchain (gcc, ld, ...)
- Software einfach portieren
- Kconfig
- Autotools, scons, cmake Abstraktionslayer
- Quilt

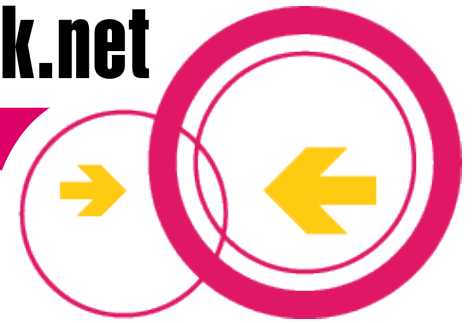
=> download, configure, compile, install



# Getting the source

```
# svn co svn://svn.openwrt.org/openwrt/trunk/
```

- toolchain/
- target/linux
- package/
- feeds/



# Feeds

Feeds.conf.default

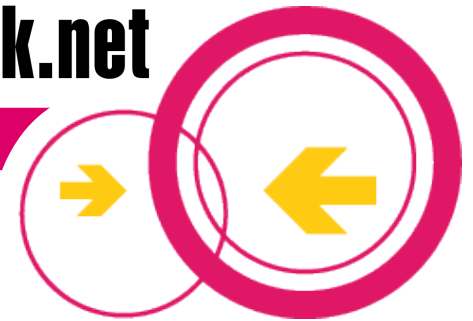
src-svn luci <http://svn.luci.subsignal.org/luci/trunk/contrib/package>

```
# ./scripts/feeds install nmap
```

```
oder
```

```
# ./scripts/feeds install -a
```

```
# ./scripts/feeds update
```



# Konfigurieren/anpassen

# make menuconfig

files/

```

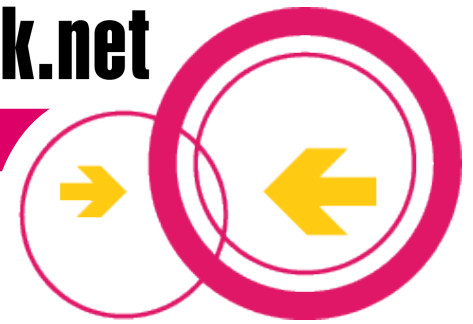
OpenWrt Backfire (unknown) Configuration

OpenWrt Configuration
Arrow keys navigate the menu. <Enter> selects submenus --->.
Highlighted letters are hotkeys. Pressing <Y> includes, <N> excludes,
<M> builds as package. Press <Esc><Esc> to exit, <?> for Help, </> for
Search. Legend: [*] built-in [ ] excluded <M> package < > package

Target System (x86) --->
Subtarget (Generic) --->
Target Profile (Generic) --->
Target Images --->
Global build settings --->
[*] Advanced configuration options (for developers) --->
[*] Build the OpenWrt Image Builder
[ ] Build the OpenWrt SDK
[ ] Build the OpenWrt based Toolchain
[ ] Image configuration --->
Package features --->
Base system --->
Libraries --->
Network --->

v(+)
```

<Select>   < Exit >   < Help >



# Image bauen

```
# make [-j x] [V=99] [IGNORE_ERRORS=m]
```

→ bin/<target>

Einzelne Komponente neu bauen

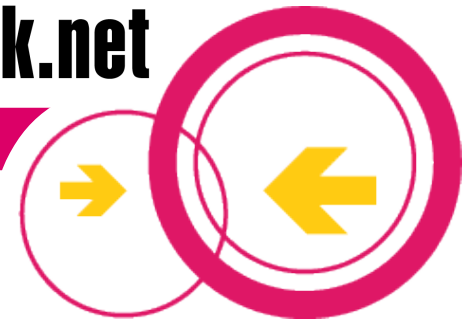
```
# make <component>/<name>/{clean,compile,install}
```

e.g.

```
# make package/opkg/{clean,compile,install}
```

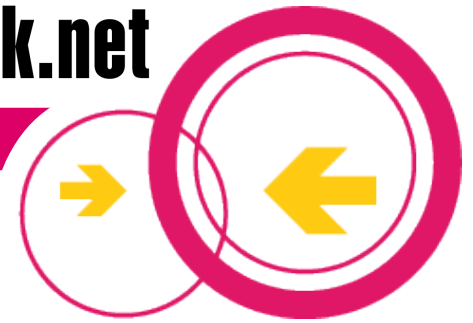
```
# make target/linux/{clean,compile,install}
```





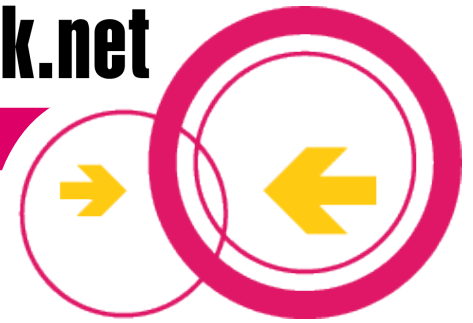
# Makefiles

```
include $(TOPDIR)/rules.mk
PKG_NAME:=bridge
PKG_VERSION:=1.0.6
PKG_RELEASE:=1
PKG_BUILD_DIR:=$(BUILD_DIR)/bridge-utils-$(PKG_VERSION)
PKG_SOURCE:=bridge-utils-$(PKG_VERSION).tar.gz
PKG_SOURCE_URL:=@SF/bridge
PKG_MD5SUM:=9b7dc52656f5cbec846a7ba3299f73bd
PKG_CAT:=zcat
include $(INCLUDE_DIR)/package.mk
define Package/bridge
    SECTION:=base
    CATEGORY:=Network
    DEFAULT:=y
    TITLE:=Ethernet bridging configuration utility
    URL:=http://bridge.sourceforge.net/
Endef
define Package/bridge/description
    Ethernet bridging configuration utility
    Manage ethernet bridging; a way to connect networks together to
    form a larger network.
Endef
define Build/Configure
    $(call Build/Configure/Default,--with-linux-headers=$(LINUX_DIR))
Endef
define Package/bridge/install
    $(INSTALL_DIR) $(1)/usr/sbin
    $(INSTALL_BIN) $(PKG_BUILD_DIR)/brctl/brctl $(1)/usr/sbin/
endef
$(eval $(call BuildPackage,bridge))
```



## Eigene patches

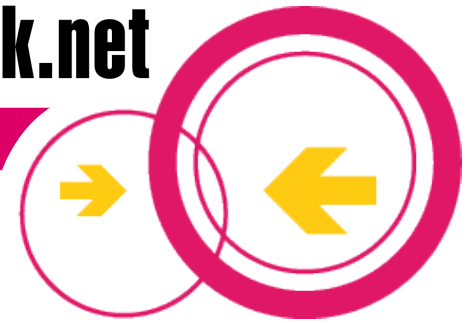
- `svn diff > my.patch`
- <https://dev.openwrt.org/wiki/SubmittingPatches>
- `openwrt-devel@lists.openwrt.org`



# Image Generator

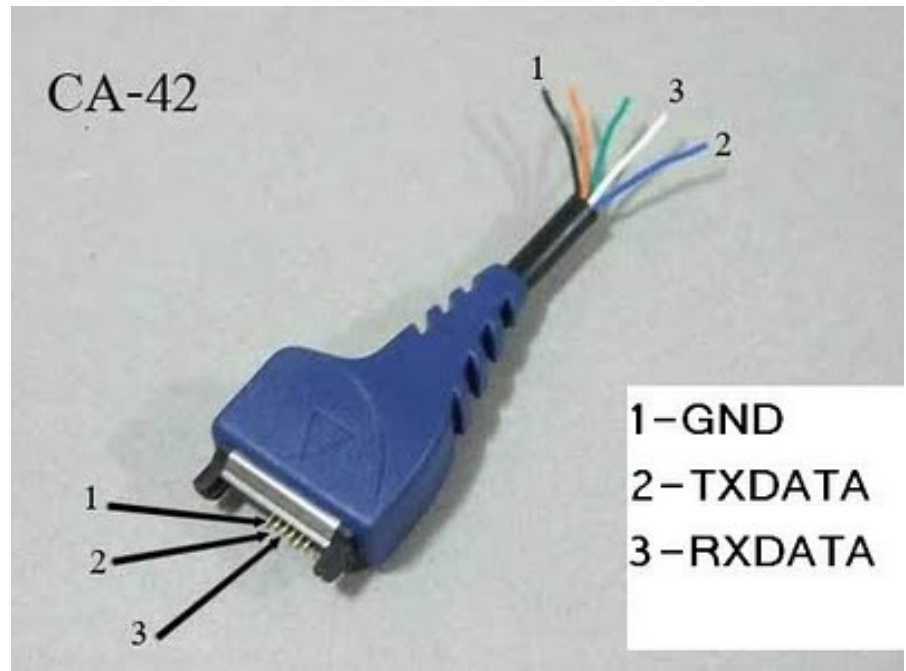
- Precompiled
- Angepasste Images schnell erstellen: Files, Targets, Settings...

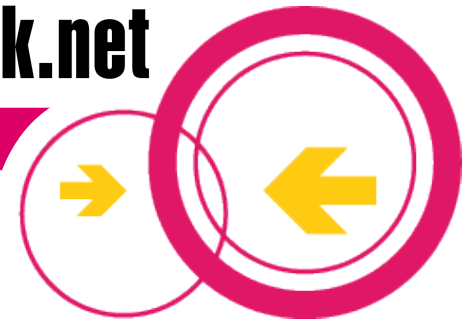
```
# make image PROFILE="UBNTRS" PACKAGES="nano" \  
FILES="./myfiles"
```



# Debricking

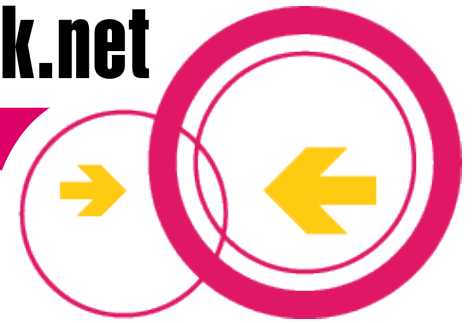
- Failsafe
- TFTP
- Serial. Srsly, get one!
- JTAG





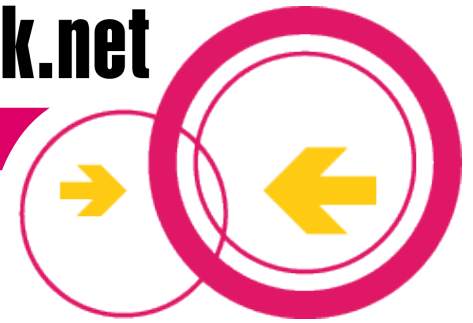
# Hardware Hacks

- RAM
- Flash
- Externer Storage
- I2C/GPIO
- USB
- Displays



# Hardware Hacks

- Modellbahnsteuerung
- Home Automation
- RC Car
- VoIP (Mesh Potato)
- WR703N Expander (Sydney Hackerspace)
- ...



# Mehr

- [openwrt.org](http://openwrt.org)
- [wiki.openwrt.org](http://wiki.openwrt.org)
- [dev.openwrt.org](http://dev.openwrt.org)